Rantakallio, P. "Relationship of Maternal Smoking to Morbidity and Mortality of the Child Up to the Age of Five" Acta Paediatr Scand 67(5): 621-631, 1978.

ABSTRACT: The effect of maternal smoking during pregnancy on the morbidity and mortality of the child up to the age of five was studied in 12068 births. The children of the smokers were compared with those of controls of similar age, parity, marital status and place of residence. Perinatal mortality was no higher among the smokers, but postneonatal mortality from 28 days to 5 years was almost significantly ($p < 0.05$) higher. The children of the smokers were highly significantly ($p < 0.001$) more often hospitalized in pediatric departments, the difference being clearest below the age of one. The average duration of hospital admissions was longer among the children of the smokers, and similarly the numbers of visits to the doctor and hospital admissions to any hospital under the age of one were more frequent among the children of the smokers. Respiratory diseases caused highly significantly more hospitalizations among these children.

(5)
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RELATIONSHIP OF MATERNAL SMOKING TO MORBIDITY AND MORTALITY OF THE CHILD UP TO THE AGE OF FIVE

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ABSTRACT. Rantakallio, P. (Department of Paediatrics and Department of Public Health, University of Oulu, Oulu, Finland). Relationship of maternal smoking to morbidity and mortality of the child up to the age of five. Acta Paediatr Scand, 67: 621, 1978.—The effect of maternal smoking during pregnancy on the morbidity and mortality of the child up to the age of five was studied in 12 068 births. The children of the smokers were compared with those of controls of similar age, parity, marital status and place of residence. Perinatal mortality was no higher among the smokers, but postneonatal mortality from 28 days to 5 years was almost significantly ($p<0.05$) high[redacted] respiratory diseases caused highly significantly more hospitalizations [redacted] children.

KEY WORDS: Maternal smoking, perinatal mortality, childhood mortality, hospital admission, out-patient visits, respiratory diseases

The fact that maternal smoking during pregnancy lowers the birth weight of the offspring is well documented. Studies on the relationship between maternal smoking and perinatal mortality are also numerous, even though the findings still contain some contradictory points (1–4, 8–12, 15, 17, 19–21, 25, 26, 31, 32, 37–40). Studies on the correlation between maternal smoking and morbidity and mortality during later childhood are relatively rare, however. Comstock & Lundin (8) reports that the childhood mortality rate up to the age of 11 was higher among children whose mothers smoked, and impaired health in the children of smokers has been investigated in several studies (5, 7, 13, 18).

The present study investigates the effect of maternal smoking on morbidity and mortality up to age of five in a series from Northern Finland in which maternal smoking habits were recorded during pregnancy.

MATERIALS AND METHOD

The series consists of 12 068 pregnant mothers from the two northernmost provinces of Finland, Oulu and Lapland. The investigation was started at the sixth or seventh month of pregnancy in the antenatal clinics and covered 96% of all deliveries in 1966 (26). Twin births numbered 163 and single births 11 905. The many biological and socio-economic characteristics of the mother and family which were examined included the mother's smoking habits. Each mother was asked whether she had been a regular smoker before pregnancy, and if so, how much she had smoked, whether she had changed her habits during pregnancy, and if so, how.

The mothers were divided into three categories in the following way:

(*a*) *non-smokers*, those who never smoked or who had stopped smoking during the first two months of pregnancy,

(*b*) *light smokers*, who smoked less than 10 cigarettes per day at the end of the second month of pregnancy, and

(*c*) *heavy smokers*, who smoked 10 or more cigarettes per day at the end of the second month of pregnancy.

In 554 mothers (4.6%) smoking data was lacking or incomplete, or in a few cases inclassifiable, e.g. when the mother did not smoke at the beginning of pregnancy but started later. *The non-smokers* amounted to 9695 mothers 80.3% of the total, and comprised 9 176 who had never

Table 1. *Perinatal mortality among the smokers and their controls*
Series is divided into social groups according to father's occupation[a]

Social group	Smokers				Controls			
	Still-births	Neonatal deaths, first 28 days	All births	Perinatal mortality per 1 000	Still-births	Neonatal deaths, first 28 days	All births	Perinatal mortality per 1 000
I+II	4	5	320	28.1	4	5	402	22.4
III+IV	16	14	1 197	25.1	10	11	1 074	19.6
Farmers	1	3	157	25.5	4	4	205	39.0
Not known[b]	2	3	170	29.4	3	3	163	36.8
Total	23	25	1 844	26.0	21	23	1 844	23.9

[a] Based on the social standing of the occupation in question (36).
[b] Mostly mother unmarried.

smoked and 519 who had stopped smoking during the first two months of pregnancy. *The mothers who smoked* totalled 1819. 1515 or 12.6% of the total number smoked less than 10 cigarettes per day, while 304 (2.5%) smoked at least 10 cigarettes per day.

The mean number of cigarettes smoked per day by the light smokers was 5.2 at the beginning of pregnancy and 3.9 in the middle of pregnancy. The corresponding figures for the heavy smokers were 15.3 and 12.2 respectively.

A control was chosen for each mother who smoked from among the non-smokers, so that the number of children born was the same, the marital status was the same, the age was the same within a range of ±2 years and the parity was the same if it was I, and otherwise of the same order, II or III, IV or V, and VI or over. The place of residence was checked for similarity on three scores: situated in the same province, having the same level of public services, taxable incomes of families and other development scores (24), all the 81 communes of the area being divided into four classes, and being similar in population density (town–village–remote village). By this manoeuvre 1750 mothers out of the total of 1819 were assigned controls, and 69 remained for whom it was impossible to find one. For these the limits of dissimilarity were widened in one or two of the characteristics with exception of the number of children born, marital status and parity I and VI+, in which the limits were kept as indicated.

All hospitalizations of the study children in the pediatric departments of the four central hospitals in the area were recorded by the members of the study group in 1972. By the time the child concerned had reached the age of 4, 7.6% of the families of the smokers and 7.0% those of controls had moved out of the study area. No inquiries were made concerning hospitalizations outside study area.

The analysis of the diagnoses given during hospitalization employs largely the main categories of diseases, and these are grouped on the basis of the manual for the statistical classification of diseases and injuries (6) in official use in Finland since 1969, which was in turn compiled with reference to the recommendations of WHO. The classification is identical with that in use in Sweden, but differs in certain minor respects from the International Classification of Disease, 1965 revision of WHO (14).

A questionnaire concerning the growth, development and health of the children at the ages of 6 and 12 months was sent to the children welfare centres in the study area in 1967. This was returned by 85.3% of the smokers and 85.6% of the controls. In this connection *all visits to the doctor and hospitalizations in departments other than pediatric departments in central hospitals and all admissions to local hospitals* supervised by a general practitioner were recorded.

The data concerning *deaths* up to the age of 5 years were collected from the Population Registration Centre and the *causes of death* from the Central Statistical Office. Since the great majority of deaths occurred before 1969, the earlier edition of the classification of diseases (22) was used in grouping the causes of death. From the point of this series, the greatest difference between the two editions lies in the "causes of perinatal morbidity and mortality", the former revision classifying most of the infectious diseases during the first 28 days into this group. Thus under this system practically all causes of death others than accidents and congenital malformations during the first 28 days were classified into this category.

Stillbirths were recorded at the postnatal clinics in connection with the other data (26), and as of 1966, all dead foetuses with a birth weight of 600 g or over were recorded as stillbirths in Finland.

The follow-up studies concerned the whole study group, not only the smokers and their controls. In testing significance the Student's *t*-test was used.

RESULTS

The smokers had 1821 live-birth children and the controls 1823. There was no statistically significant difference in the number of boys and girls born to the different smoking groups, nor was there any difference in the number of twin pregnancies.

Table 2. *Postneonatal mortality from 28 days to 5 years among the smokers and their controls*
Series is divided into social groups according to father's occupation*

	Smokers			Controls		
Social group	Deaths (*N*)	Alive after neonatal period (*N*)	Per 1 000	Deaths (*N*)	Alive after neonatal period (*N*)	Per 1 000
I+II	2	311	6.4	2	393	5.1
III+IV	13	1 167	11.1	4	1 053	3.8
Farmers	2	153	13.1	0	197	0.0
Not known[b]	3	165	18.2	1	157	6.4
Total	20	1 796	11.1	7	1 800	3.9

* Based on the social standing of the occupation in question (36).
[b] Mostly mother unmarried.

Perinatal mortality in smokers and controls by social groups is presented in Table 1. The difference between groups was not statistically significant either for the total groups or subgroups. The effect of the slightly different distribution into social groups among the smokers and controls was checked by repeating the calculation using the mortality rate of the controls and the total number of cases among the smokers for each social group. The perinatal mortality was thus 23.4 per thousand instead of the true figure 23.9 per thousand in the controls, the difference being without significance. The mortality rate was higher among the heavy smokers than in the other groups, 32.6 for the heavy smokers and 25.7 per thousand for the light smokers, but the difference was without statistical significance.

Table 2 depicts the *postneonatal mortality* in the [illegible] difference between the total groups of smokers and controls was statistically almost significant ($p<0.05$). The difference was appreciable in each social group except the highest. When the postneonatal mortality was calculated for the controls for the case in which the distribution into social groups would be the same as among the smokers the result was not affected, being 3.9 per thousand. The figures for heavy and light smokers were about the same, 13.0 and 11.1 per thousand respectively.

Visits to the doctor and *hospital admissions* to any hospital in the area were recorded up to age of one year for 1 554 children of smokers and 1 560 children of controls. As may be seen from the results presented in Table 3, the chil-

Table 3. *Visits to the doctor and hospital admissions at the age of under one year, by smoking groups*
Visits to all hospitals in the study area are included

	Number of live births	Visits to the doctor			Hospitalizations		
		Children (*N*)	Visits (*N*)	Visits, mean for group	Children (*N*)	Visits (*N*)	Visits, mean for group
Light smokers	1 302	712	986	0.76	223	292	0.22
Controls	1 300	672⁻	927*	0.71⁻	190⁻	253⁻	0.19⁻
Heavy smokers	252	160	210	0.83	70	98	0.39
Controls	258	120***	157***	0.61**	33***	38***	0.15***
All smokers	1 554	872	1 196	0.77	293	390	0.25
Controls	1 558	792**	1 084***	0.69*	223***	291***	0.19**

⁻$p>0.05$, *$p<0.05$, **$p<0.01$, ***$p<0.001$.

Table 4. *Hospital admissions by smoking groups*

Admissions to the pediatric departments of the four central hospitals in the study area

	Alive at age		Age under one			Age one to five		
	0 year (*N*)	1 year (*N*)	Children (*N*)	Visits (*N*)	Mean for group	Children (*N*)	Visits (*N*)	Mean for group
Light smokers	1 518	1 486	207	263	0.17	209	320	0.22
Controls	1 520	1 499	170*	209**	0.14*	154**	231***	0.15*
Heavy smokers	303	295	63	90	0.30	40	73	0.25
Controls	303	299	22***	25***	0.08***	42⁻	50*	0.17⁻
All smokers	1 821	1 781	270	353	0.19	249	393	0.22
Controls	1 823	1 798	192***	234***	0.13***	196**	281***	0.16**

⁻$p>0.05$, *$p<0.05$, **$p<0.01$, ***$p<0.001$.

Even of the smokers visited the doctor more often and were more often admitted to the hospital than those of the controls. The difference in the number of children visits and means for the groups having attained degree of statistical significance. It is also clear that the differences are chiefly attributable to the effect of the heavy smokers.

Hospital admission to the pediatric departments of the four central hospitals in the area were recorded for all children born to the smokers and controls (1821 and 1823). The results are presented in Table 4 separately for age under one year and for age from one to five. The children of the smokers had significantly more hospital admissions than those of the controls. The difference was more due to the group of heavy smokers in the case of children of under one year, but this was no longer true for the age from one to five years.

The difference between the smokers and the controls in the percentage of children *hospitalized during the first five years* was almost significant ($p<0.05$): the figures were 7.6% in former and 5.9% in the latter group.

Table 5 presents the number of children *hospitalized* per thousand live births among the smokers and controls *by social groups*. The children of each social group were more often hospitalized if their mother smoked during pregnancy than if she did not, with the exception of the group of more well-to-do farmers. In the case that the total number of cases among the controls had distributed into social

Table 5. *The children of the smokers and their controls admitted to pediatric departments during the first 5 years of life*

Series is divided into social groups according to father's occupation[a]

	Smokers (*N* 1821)		Controls (*N* 1823)	
Social group	Hospitalized children	Per thousand live births	Hospitalized children	Per thousand live births
I	14	202.9	20	170.9
II	58	234.8	44	156.6
III	185	265.0	137	213.4
IV	114	236.0	85	201.4
Farmers I[b]	5	102.0	12	131.9
Farmers II	29	271.0	23	209.1
Not known[c]	43	256.0	22	137.5
Total	448	246.0	343	188.2

[a] Based on the social standing of the occupation in question (36).
[b] Land under cultivation 8 hectares or over.
[c] Mostly mother unmarried.

Table 6. *Incidence of diseases during the first 5 years among the children of the smokers and the controls*

Incidence is based on all diagnoses given during hospital admissions in pediatric departments

Diagnosis	Smokers (*N* 1821)		Controls (*N* 1823)	
	N	Per thousand live births	*N*	Per thousand live births
Infective and parasitic dis.	118	64.8	103	56.5
Neoplasms	3	1.6	5	2.7
Endocrine, nutritional, and metabolic dis.	23	12.6	21	11.5
Dis. of the blood and bloodforming organs	85	46.7	48	26.3**
Mental disorders	5	2.7	11	6.0
Dis. of the nervous system and sense organs	90	49.4	52	28.5**
Dis. of the circulatory system	3	1.6	6	3.3
Dis. of the respiratory system	311	170.8	179	98.2***
Dis. of the digestive system	39	21.4	34	18.7
Dis. of the genito-urinary system	53	29.1	33	18.1*
Dis. of the skin and subcutaneous tissue	41	22.5	15	8.2***
Dis. of the musculoskeletal system and connective tissue	11	6.0	4	2.2
Congenital anomalies	44	24.2	51	28.0
Causes of perinatal morbidity and mortality	176	96.6	128	70.2**
Symptoms and ill-defined conditions	67	36.8	54	29.6
Accidents, poisonings and violence	39	21.4	25	13.7
Examination and investigation	14	7.7	12	6.6
Total	1 122	616.1	781	428.4

*$p<0.05$, **$p<0.01$, ***$p<0.001$.

groups as those of the smokers, 191.5 instead of 188.2 children per thousand had been hospitalized among the controls, the difference being without significance.

The mean duration of hospitalization was 14.0 days for the children of the smokers and 13.1 days in those of the controls, the difference being statistically highly significant. The mean duration of hospitalizations among the heavy smokers was 14.9 days among the light smokers 13.7 days.

Table 6 presents the *frequency of all disease groups* diagnosed in children's departments *per thousand live births* among the children of smokers and of their controls. If the child had been in hospital more than once for the same disease it was counted only once. Respiratory and skin diseases were more frequent among the smokers than among the controls, the difference being statistically highly significant ($p<0.001$), and the children of smokers also had blood and nervous diseases and disease of the newborn period more often, the difference being statistically significant ($p<0.01$). Among the respiratory diseases the ratio of the incidence among the smokers to that of the controls was 2.2 in pneumonia and bronchitis, and 1.8 in others such as acute nasopharyngitis, sinusitis etc. In addition, two cases of pulmonary atelectasis and one of empyema were recorded among the smokers but none among the controls.

Among the skin diseases the ratio of the incidence among the smokers to that among the controls was 2.7 in eczema and urticaria and 2.0 in infectious diseases of the skin and subcutaneous tissue and other diseases of this category.

Under the age of one year the difference in the diseases was in general greater between the heavy smokers and their controls than between the light smokers and their controls, but this was no longer true for the age from one to five.

When the *main causes* of hospitalization in pediatric departments per thousand live births was calculated for both groups a statistically highly significant difference ($p<0.001$) was

Table 7. *Causes of death at age under five years among the children of the smokers and their controls*

Diagnosis	Smokers (N 1821)		Controls (N 1823)	
	N	Per thousand live births	*N*	Per thousand live births
Infective and parasitic dis.	4	2.20	0	0.00
Neoplasms	2	1.10	1	0.55
Mental disorders	0	0.00	1*	0.55
Dis. of the nervous system and sense organs	4	2.20	1	0.55
Dis. of the respiratory system	5	2.75	1	0.55
Dis. of the digestive system	0	0.00	1	0.55
Dis. of the genito-urinary system	0	0.00	0	0.00
Congenital anomalies	4	2.20	7	3.84
Causes of perinatal morbidity and mortality	23	12.63	16	8.78
Accidents, poisonings, and violence	3	1.65	2	1.10
Total	45	24.71	30	16.47

* Down's syndrome.

found only in the case of respiratory diseases, and an almost significant difference ($p<0.05$) in the case of skin diseases. The more frequent hospitalizations of the children of smokers because of respiratory diseases was clearest below the age of one, but also existed at the age of one to five, the difference between the smokers and controls in that age being almost significant ($p<0.05$). Again the children of the heavy smokers were more affected than those of the light smokers under the age of one, but not at the age of one to five.

Since the higher frequency of other disease groups than respiratory diseases diagnosed among the children of smokers might be the result of more frequent hospitalization in the case of respiratory diseases, the differences in the frequencies of skin, blood, and nervous diseases and sense organs and diseases of the newborn period between the smokers and their controls were also calculated excluding those hospitalizations in which the main diagnosis was respiratory disease. In this case the difference in skin diseases was statistically significant ($p<0.01$) those in diseases of the newborn period and nervous diseases almost significant ($p<0.05$) and that in blood diseases without significance.

The hospital visits were studied *by seasons of the year* taking the months from November to March as winter, from May to September as summer and the rest combined as the spring and autumn period. The difference between the smokers and the controls in the mean number of hospitalizations per child was almost significant in summer, significant in winter and almost significant in spring and autumn period. No clear trend was found for hospital admissions due to respiratory diseases to be any more accentuated among the children of smokers during the winter, even though the absolute figures for hospital admissions because of respiratory diseases were certainly greater during the winter both for the smokers and the controls.

On the diagnoses given during admission to the hospital in the area in the case of children under one year of age a highly significant difference ($p<0.001$) was found between the children of the smokers and those of the controls in respiratory diseases, the frequencies being 88.1 and 43.5 per thousand respectively. In blood diseases the differences was almost significant ($p<0.05$).

As causes of visits to the doctor under one year of age the children of smokers had a statistically almost significantly ($p<0.05$) higher frequency for the respiratory diseases, blood diseases, diseases of the genitourinary system and the group of endocrine, nutritional

and metabolic diseases. The frequency of respiratory diseases was 435.3 per thousand among the children of the smokers and 390.2 per thousand among the controls.

45 children of smokers and 30 children of controls *died* before the age of 5 years. *The causes of death*, calculated per thousand live births, are seen in Table 7. 38 children of the smokers and 29 children of the controls were in hospital at the time of death. The recorded cause of death was based on autopsy in 59 cases. Among the 8 cases who were not in hospital at the time of death, 4 were accidental deaths and 2 died of pneumonia, 1 of meningococcal septicaemia and 1 of cerebral palsy. The disease groups which were commonest among the children of smokers [illegible] controls but the differences were not statistically significant.

DISCUSSION

The number of smokers in this series is considerably lower than in most other series reported. Goldstein (12) has tabulated the figures for the six largest series commonly referred to in connection with maternal smoking and its effect on the foetus and the child, having as the lowest percentage of smokers at the beginning of pregnancy the 21% of this series (26), while the figures in the other series vary from 32 to 54%. During the two first months of pregnancy the number of smokers in this series had dropped to 15.1%.

The average *number of cigarettes smoked* in this series was probably also lower than in the other series, even though it is not easy to make comparisons with other studies because of the different criteria used for the classification into light and heavy smokers. For example, the Ontario Perinatal Mortality study (20) used the maximum number smoked per day any time during pregnancy, the light smokers being those who smoked less than one packet and the heavy smokers those who smoked more than one packet. Thus the group classified in this series as heavy smokers may show more similarity with the light smokers than the heavy smokers in the Ontario study.

According to Butler & Goldstein (4) *abandonment of smoking* by the fourth month *of pregnancy* gives a mortality risk and expected birth weight comparable to those for mothers who are not smokers. The findings of Donovan (10) are, however, not in full agreement with this. In an earlier analysis of this series (26) it was shown that perinatal mortality was not significantly higher among smokers than among non-smokers when the group of smokers was taken to include all those who smoked regularly at the beginning of the pregnancy. In view of the findings by Butler & Goldstein mentioned above and since those who stopped smoking during pregnancy in this series were also known to be on average lighter smokers than those who continued, it was reasonable to exclude the 519 mothers who did not smoke after the second month of pregnancy, who formed about one fifth of the original group, in order to highlight the effects of maternal smoking. On the other hand, a separate analysis was also made of those who had only stopped smoking during the last three months of pregnancy, and even this subgroup showed similar figures for postneonatal mortality and morbidity up to the age of 5 to those of their controls (29).

In the choice of the controls great attention was paid to obtaining the best possible match with the study group in respect of the place of residence. This was done because one of the most prominent among the many differences between the smokers and non-smokers was the concentration of the smokers in the population centres, and in this extensive study area —160 000 km² (26)—the regional differences in childhood mortality and the use of the health care services are in many respects more important than the social class differences between the families (27, 28). Since the controls also had to be similar to the smokers in respect

of maternal age, parity, marital status and number of children born, it was not possible to set any additional demands for similarity between the groups. As seen from Tables 1, 2 and 5, the slightly different distribution into social groups among the smokers and controls did not affect the results.

The method of collecting the data on admissions to children's departments differed from that used for ascertaining admissions to any hospitals in the area or out-patient visits, the former being recorded directly from the hospital records and the latter two being collected by questionnaire from the child welfare centres. It is probable that in the latter two cases some under-estimation may exist, but this would affect the study group and controls similarly. The effects of regional differences were carefully eliminated when the control was chosen and the maternal smoking was not indicated in any phase of the follow-up study. 91.5% of the children in the northern province and 95.4% in the southern province were registered at a child welfare centre before the age of one in 1967 (23).

The studies most commonly referred to in which no adverse effect of maternal smoking on *perinatal mortality* is found are those of Järvinen & Österlund (15), O'Lane (17), Peterson et al. (25), Underwood et al. (37, 38), Yerusalmy (39, 40) and the present series (26). Sets of data showing that maternal smoking may also have an adverse effect on perinatal mortality have become more numerous, however, the best known investigations being those of Andrews & McGarry (1), Bailey (2), Butler et al. (3, 4) Comstock et al. (8, 9), Fabia (11), Russel et al. (32), Meyer et al. (19–21) and Rush & Kass (31).

In order to explain the contradictory findings [illegible] that smoking is harmful to the infants of some groups of women than others (19, 20). In the Ontario Perinatal Mortality Study, Meyer et al. (20) found that the increased risk of perinatal mortality due to maternal smoking was low if the mother was young, of low parity, non-anemic and smoked lightly, but high if the mother was of high parity, of public hospital status, had previous low birth-weight infants, or had a low hemoglobin level. Similarly Rush & Kass (31) found that black smokers had a perinatal mortality rate considerably higher than other groups, while among white mothers the effect of smoking was of lesser magnitude. In Washington County study (8) the higher mortality rate caused by maternal smoking was most marked among families who ranged low on socio-economic characteristics and the infants of primiparas and young mothers were less likely to suffer in this way.

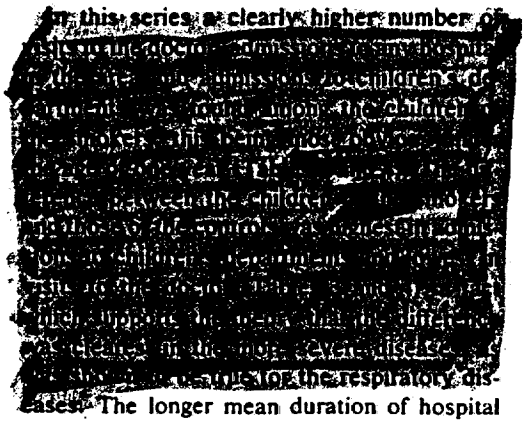
Even though the lowering effect of maternal smoking on the birth weight in this series was clear (26, 29) the perinatal mortality was no higher among the smokers, and no clear trend for maternal smoking to be more injurious in the lower social groups was found (Table 1). One possible explanation for this deviant result is the small number of heavy smokers in the series and the fact that the smokers were in general young, low parity women (30).

The finding that maternal smoking increased *childhood mortality after the perinatal period* is similar to that of Comstock & Lundin (8), the two highest social groups being least affected (Table 2).

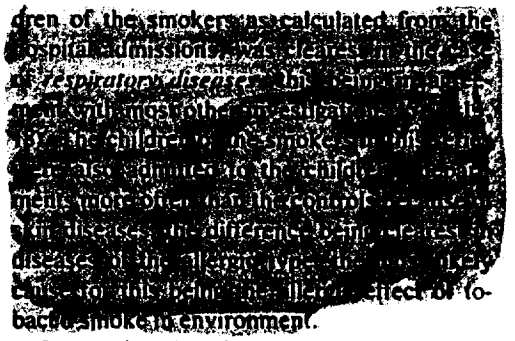
In contrast to the dissimilar findings concerning maternal smoking [illegible] mortality in different series, the few investigations made on the effect of maternal smoking in *childhood morbidity* mainly agree well, especially for children under one-year of age.

In the study by Cameron et al. (5) based on telephone interviews with 727 Detroit metropolitan families it was found that the presence of tobacco smoke in the environment was associated with poorer physical health in children aged 16 or less, respiratory diseases being the most common causes of illness. Harlap & Davies (13) have investigated admissions to hospital in West Jerusalem infants during their first year of life, noting that the infants of mothers who smoked during pregnancy, 9.2%

of the total of about 10000 interviewed, had significantly more admissions for respiratory diseases, especially in the winter, and more injuries than the infants of non-smokers. Colley et al. (7) and Leeder et al. (18) investigated 2205 families in northwest London and found an association with parental smoking in the incidence of pneumonia and bronchitis under five, this finding being clearest for those under one year of age. Concerning the older children, the opposite has been reported in a couple of studies, Shy et al. (34) did not find any relationship between parents' smoking and respiratory diseases among second-grade school children, and in the study by Schilling et al. (33) the findings concerning children between the ages of seven and 18 were similarly negative, Kerrebijn et al. (16) also observed that smoking and non-smoking parents had about the same proportion of school-age children with respiratory symptoms. They also point out that if the respiratory symptoms of the smoking parents themselves were studied simultaneously it could be shown that it is more a question of the relationship between the symptoms of the parents and those of the children than between the tobacco smoke in the environment and the children's symptoms.

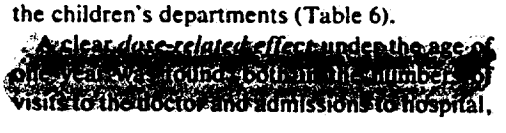


The longer mean duration of hospital admissions among the children of smokers, a finding departing from that of Harlap & Davies (13), is most probably also an index of the higher degree of severity of their diseases.



Concerning the diagnoses which were not the main causes of hospital admission but given during hospitalizations, it is difficult to judge if any real difference exists between the groups. It may be a question either of children taken into hospital for one reason being more likely to acquire other diagnoses more frequently than those not taken into hospital, or of children suffering from one disease being more prone to others. The latter is true, for example, in the case of iron deficiency anemia, the most common blood disease among Finnish children, for children with frequent or serious respiratory infections are also more disposed to this type of anemia. On the other hand, the lesser degree of significance is not necessarily a sign of a smaller difference between the groups, but may also reflect the smaller number of cases in the group, which is the case when only some of the hospital admissions are concerned.

The difference in respiratory diseases between the children of the smokers and of the controls was not so clear in the causes of visits to the doctor as in the causes of hospital admissions. Part of the explanation at least, may be found in the fact that the difference between the groups is clearest in the more severe diseases. However, the most frequent causes of out-patient visits among the children of the smokers were mainly found in the same diseases groups as in the diagnoses given in the children's departments (Table 6).



and in the frequencies of the diseases, the children of heavy smokers being more seriously affected. The explanation for the fact that this was no longer true for children of the age of one to five may lie in the greater resistance of this age group, but also be related to the fact that maternal smoking habits were recorded only during the pregnancy and overlapping has occurred between the groups of heavy and light smokers and even between the smokers and non-smokers in the course of the years. On the other hand, the small number of heavy smokers in the series makes this group more easily effected by random variation than the five times larger group of light smokers.

In contrast to the study on Jerusalem infants by Harlap & Davies (13), no clear trend was found in this series for hospital admission caused by maternal smoking to be more frequent in winter. Part of the explanation, at least, may lie in the fact that the healthiest period for Finnish children is not exactly identical with the summer months, but is located on average during later summer and early autumn, May and June still being quite busy times in pediatric practise.

Maternal smoking was recorded during pregnancy only. It is clear that most mothers who do not stop smoking during pregnancy do not do so at all. This is discussed more fully in another context (29). Paternal smoking was not recorded in this study, as is the case with most mother–child studies. However, mothers spend more time at home on average than do fathers, especially during their children's early years and, on the other hand, it is obvious that it will not be any more common for the father to smoke in families where the mother does not than in those whose she does.

In order to explain the differences found between the children of the smokers and the controls the following hypotheses can be presented. First, it can be assumed that even if the controls were chosen as carefully as possible from the five times larger group of non-smokers, they would not differ from these only in their smoking habits, but in several other respects, e.g. in their biological characteristics, in their manner of taking care of their own health and that of their children, in their dietary habits, frequency of breast-feeding, and so on. In fact, some doubts are still expressed as to whether any true causal relationship exists between maternal smoking and increased perinatal mortality or reduced birth weight (10, 12, 35). At the same time, however, Goldstein (12) has shown that: "Various attempts to falsify the causal hypotheses have failed, leaving us with good reason for acting as if smoking really did cause a decrease in birthweight and an increased risk of perinatal mortality."

If we accept the causal theory also in respect of the later childhood period, we still have to judge which is more important, the foetal period or the infancy period. For the diseases in which the children of the smoker differed most from the others in this series, the respiratory and skin diseases, it seems reasonable that the smoke in the environment should be most important. However, the importance of other contributing factors such as lower birth weight has not yet been analysed thoroughly.

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